

1. Determine the vertical asymptotes and holes in the rational function below.

$$f(x) = \frac{16x^3 + 72x^2 + 17x - 60}{8x^2 - 2x - 15}$$

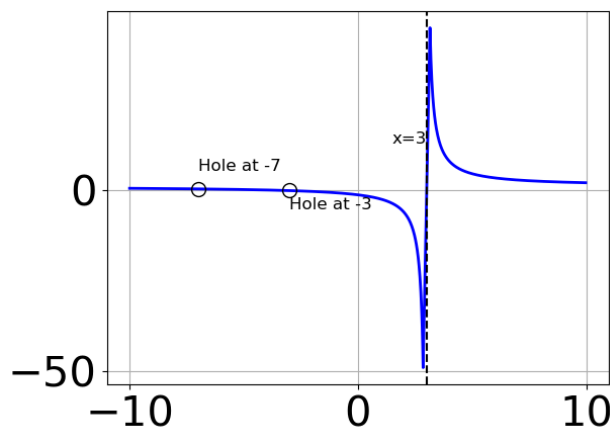
- A. Vertical Asymptotes of  $x = 1.5$  and  $x = 0.75$  with a hole at  $x = -1.25$
  - B. Vertical Asymptote of  $x = 2.0$  and hole at  $x = -1.25$
  - C. Vertical Asymptote of  $x = 1.5$  and hole at  $x = -1.25$
  - D. Holes at  $x = 1.5$  and  $x = -1.25$  with no vertical asymptotes.
  - E. Vertical Asymptotes of  $x = 1.5$  and  $x = -1.25$  with no holes.
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2. Determine the vertical asymptotes and holes in the rational function below.

$$f(x) = \frac{6x^3 + 5x^2 - 16x - 15}{8x^2 + 6x - 9}$$

- A. Vertical Asymptote of  $x = 0.75$  and hole at  $x = -1.5$
  - B. Vertical Asymptotes of  $x = 0.75$  and  $x = -1.5$  with no holes.
  - C. Vertical Asymptote of  $x = 0.75$  and hole at  $x = -1.5$
  - D. Holes at  $x = 0.75$  and  $x = -1.5$  with no vertical asymptotes.
  - E. Vertical Asymptotes of  $x = 0.75$  and  $x = 1.667$  with a hole at  $x = -1.5$
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3. Which of the following functions *could* be the graph below?



- A.  $f(x) = \frac{x^3 + 8.0x^2 + 4.0x - 48.0}{x^3 + 7.0x^2 - 9.0x - 63.0}$
- B.  $f(x) = \frac{x^3 - 14.0x^2 + 61.0x - 84.0}{x^3 - 7.0x^2 - 9.0x + 63.0}$
- C.  $f(x) = \frac{x^3 + 14.0x^2 + 61.0x + 84.0}{x^3 + 7.0x^2 - 9.0x - 63.0}$
- D.  $f(x) = \frac{x^3 - 11.0x^2 + 38.0x - 40.0}{x^3 - 7.0x^2 - 9.0x + 63.0}$
- E. None of the above are possible equations for the graph.

4. Determine the vertical asymptotes and holes in the rational function below.

$$f(x) = \frac{12x^3 - 47x^2 + 60x - 25}{12x^2 - 31x + 20}$$

- A. Vertical Asymptotes of  $x = 1.333$  and  $x = 1.25$  with no holes.
- B. Vertical Asymptote of  $x = 1.0$  and hole at  $x = 1.25$
- C. Vertical Asymptotes of  $x = 1.333$  and  $x = 1.667$  with a hole at  $x = 1.25$
- D. Holes at  $x = 1.333$  and  $x = 1.25$  with no vertical asymptotes.
- E. Vertical Asymptote of  $x = 1.333$  and hole at  $x = 1.25$

5. Determine the horizontal and/or oblique asymptotes in the rational function below.

$$f(x) = \frac{6x^3 - 7x^2 - 43x + 30}{2x^2 + 13x + 20}$$

- A. Oblique Asymptote of  $y = 3x - 23$ .
  - B. Horizontal Asymptote of  $y = 3.0$  and Oblique Asymptote of  $y = 3x - 23$
  - C. Horizontal Asymptote of  $y = -4.0$  and Oblique Asymptote of  $y = 3x - 23$
  - D. Horizontal Asymptote at  $y = -4.0$
  - E. Horizontal Asymptote of  $y = 3.0$
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6. Determine the horizontal and/or oblique asymptotes in the rational function below.

$$f(x) = \frac{8x^3 + 10x^2 - 21x - 18}{20x^3 + 38x^2 + 52x + 12}$$

- A. Vertical Asymptote of  $y = -0.400$
  - B. None of the above
  - C. Vertical Asymptote of  $y = -2$
  - D. Horizontal Asymptote of  $y = 0$
  - E. Horizontal Asymptote of  $y = 0.400$
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7. Determine the vertical asymptotes and holes in the rational function below.

$$f(x) = \frac{12x^3 + 37x^2 - 59x - 60}{9x^2 - 9x - 10}$$

- A. Vertical Asymptote of  $x = 1.333$  and hole at  $x = 1.667$
- B. Holes at  $x = -0.667$  and  $x = 1.667$  with no vertical asymptotes.
- C. Vertical Asymptote of  $x = -0.667$  and hole at  $x = 1.667$

- D. Vertical Asymptotes of  $x = -0.667$  and  $x = -0.75$  with a hole at  $x = 1.667$
- E. Vertical Asymptotes of  $x = -0.667$  and  $x = 1.667$  with no holes.
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8. Determine the horizontal and/or oblique asymptotes in the rational function below.

$$f(x) = \frac{16x^3 - 64x^2 - 9x + 36}{4x^2 - 17x - 15}$$

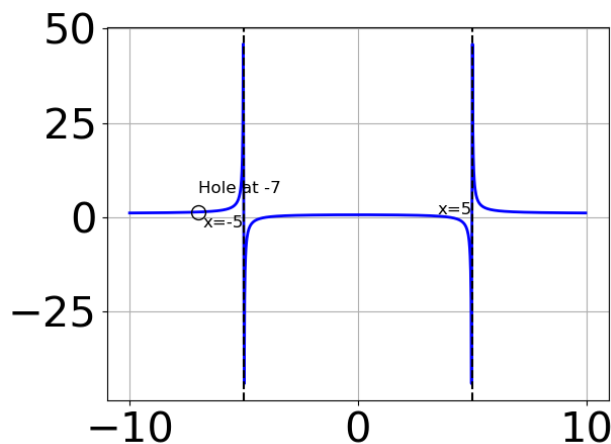
- A. Oblique Asymptote of  $y = 4x + 1$ .
- B. Horizontal Asymptote at  $y = 5.0$
- C. Horizontal Asymptote of  $y = 4.0$
- D. Horizontal Asymptote of  $y = 4.0$  and Oblique Asymptote of  $y = 4x + 1$
- E. Horizontal Asymptote of  $y = 5.0$  and Oblique Asymptote of  $y = 4x + 1$
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9. Determine the horizontal and/or oblique asymptotes in the rational function below.

$$f(x) = \frac{4x^2 + 21x + 20}{20x^3 + 73x^2 + 24x - 45}$$

- A. Horizontal Asymptote of  $y = 0.200$  and Oblique Asymptote of  $y = 5x - 8$
- B. Horizontal Asymptote of  $y = 0$
- C. Oblique Asymptote of  $y = 5x - 8$ .
- D. Horizontal Asymptote of  $y = 0.200$
- E. Horizontal Asymptote at  $y = -4.000$
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10. Which of the following functions *could* be the graph below?



- A.  $f(x) = \frac{x^3 + 7.0x^2 - 16.0x - 112.0}{x^3 + 7.0x^2 - 25.0x - 175.0}$
- B.  $f(x) = \frac{x^3 + 4.0x^2 - 16.0x - 64.0}{x^3 + 7.0x^2 - 25.0x - 175.0}$
- C.  $f(x) = \frac{x^3 - 7.0x^2 - 16.0x + 112.0}{x^3 - 7.0x^2 - 25.0x + 175.0}$
- D.  $f(x) = \frac{x^3 - 4.0x^2 - 16.0x + 64.0}{x^3 - 7.0x^2 - 25.0x + 175.0}$
- E. None of the above are possible equations for the graph.

11. Determine the vertical asymptotes and holes in the rational function below.

$$f(x) = \frac{8x^3 - 38x^2 + 15x + 36}{12x^2 + 29x + 15}$$

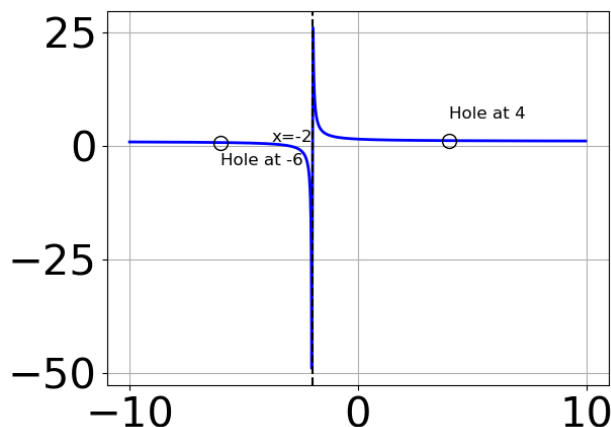
- A. Vertical Asymptote of  $x = 0.667$  and hole at  $x = -0.75$
- B. Vertical Asymptotes of  $x = -1.667$  and  $x = 1.5$  with a hole at  $x = -0.75$
- C. Vertical Asymptote of  $x = -1.667$  and hole at  $x = -0.75$
- D. Holes at  $x = -1.667$  and  $x = -0.75$  with no vertical asymptotes.
- E. Vertical Asymptotes of  $x = -1.667$  and  $x = -0.75$  with no holes.

12. Determine the vertical asymptotes and holes in the rational function below.

$$f(x) = \frac{6x^3 - 35x^2 + 63x - 36}{6x^2 + 7x - 20}$$

- A. Vertical Asymptotes of  $x = -2.5$  and  $x = 1.333$  with no holes.
- B. Vertical Asymptote of  $x = 1.0$  and hole at  $x = 1.333$
- C. Vertical Asymptote of  $x = -2.5$  and hole at  $x = 1.333$
- D. Holes at  $x = -2.5$  and  $x = 1.333$  with no vertical asymptotes.
- E. Vertical Asymptotes of  $x = -2.5$  and  $x = 1.5$  with a hole at  $x = 1.333$

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13. Which of the following functions *could* be the graph below?



- A.  $f(x) = \frac{x^3 + 8.0x^2 - 3.0x - 90.0}{x^3 - 4.0x^2 - 20.0x + 48.0}$
- B.  $f(x) = \frac{x^3 - 6.0x^2 - 9.0x + 54.0}{x^3 + 4.0x^2 - 20.0x - 48.0}$
- C.  $f(x) = \frac{x^3 + 5.0x^2 - 18.0x - 72.0}{x^3 + 4.0x^2 - 20.0x - 48.0}$
- D.  $f(x) = \frac{x^3 - 5.0x^2 - 18.0x + 72.0}{x^3 - 4.0x^2 - 20.0x + 48.0}$
- E. None of the above are possible equations for the graph.

14. Determine the vertical asymptotes and holes in the rational function below.

$$f(x) = \frac{9x^3 - 12x^2 - 20x + 16}{9x^2 - 21x + 10}$$

- A. Vertical Asymptote of  $x = 1.0$  and hole at  $x = 0.667$
  - B. Vertical Asymptotes of  $x = 1.667$  and  $x = -1.333$  with a hole at  $x = 0.667$
  - C. Vertical Asymptote of  $x = 1.667$  and hole at  $x = 0.667$
  - D. Holes at  $x = 1.667$  and  $x = 0.667$  with no vertical asymptotes.
  - E. Vertical Asymptotes of  $x = 1.667$  and  $x = 0.667$  with no holes.
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15. Determine the horizontal and/or oblique asymptotes in the rational function below.

$$f(x) = \frac{12x^3 + 71x^2 + 130x + 75}{4x^2 - 11x - 20}$$

- A. Horizontal Asymptote at  $y = 4.0$
  - B. Oblique Asymptote of  $y = 3x + 26$ .
  - C. Horizontal Asymptote of  $y = 3.0$  and Oblique Asymptote of  $y = 3x + 26$
  - D. Horizontal Asymptote of  $y = 3.0$
  - E. Horizontal Asymptote of  $y = 4.0$  and Oblique Asymptote of  $y = 3x + 26$
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16. Determine the horizontal and/or oblique asymptotes in the rational function below.

$$f(x) = \frac{5x^2 + 24x + 16}{20x^3 + 31x^2 - 38x - 40}$$

- A. Horizontal Asymptote at  $y = -4.000$
- B. Horizontal Asymptote of  $y = 0$

- C. Oblique Asymptote of  $y = 4x - 13$ .
  - D. Horizontal Asymptote of  $y = 0.250$  and Oblique Asymptote of  $y = 4x - 13$
  - E. Horizontal Asymptote of  $y = 0.250$
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17. Determine the vertical asymptotes and holes in the rational function below.

$$f(x) = \frac{12x^3 - 5x^2 - 17x + 10}{12x^2 - 17x + 6}$$

- A. Vertical Asymptote of  $x = 1.0$  and hole at  $x = 0.667$
  - B. Vertical Asymptotes of  $x = 0.75$  and  $x = 0.667$  with no holes.
  - C. Vertical Asymptote of  $x = 0.75$  and hole at  $x = 0.667$
  - D. Vertical Asymptotes of  $x = 0.75$  and  $x = -1.25$  with a hole at  $x = 0.667$
  - E. Holes at  $x = 0.75$  and  $x = 0.667$  with no vertical asymptotes.
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18. Determine the horizontal and/or oblique asymptotes in the rational function below.

$$f(x) = \frac{16x^3 - 16x^2 - 9x + 9}{4x^2 - 9x - 9}$$

- A. Oblique Asymptote of  $y = 4x + 5$ .
  - B. Horizontal Asymptote of  $y = 4.0$
  - C. Horizontal Asymptote at  $y = 3.0$
  - D. Horizontal Asymptote of  $y = 3.0$  and Oblique Asymptote of  $y = 4x + 5$
  - E. Horizontal Asymptote of  $y = 4.0$  and Oblique Asymptote of  $y = 4x + 5$
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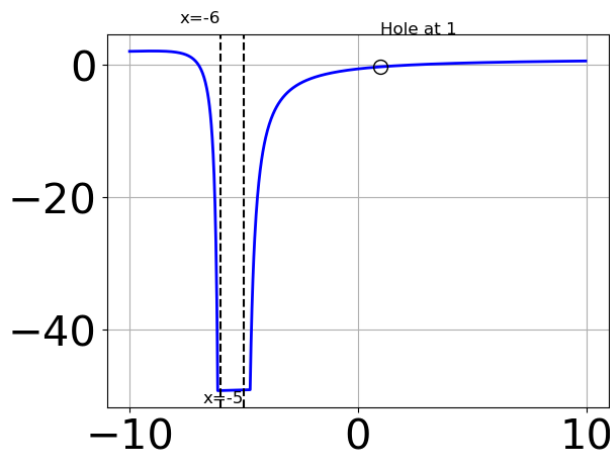


19. Determine the horizontal and/or oblique asymptotes in the rational function below.

$$f(x) = \frac{8x^3 + 42x^2 + 67x + 30}{8x^3 + 50x^2 + 85x + 50}$$

- A. Vertical Asymptote of  $y = -2$
- B. Horizontal Asymptote of  $y = 0$
- C. Vertical Asymptote of  $y = -1.250$
- D. Horizontal Asymptote of  $y = 1.000$
- E. None of the above

20. Which of the following functions *could* be the graph below?



- A.  $f(x) = \frac{x^3 - 3.0x^2 - 25.0x - 21.0}{x^3 - 10.0x^2 + 19.0x + 30.0}$
- B.  $f(x) = \frac{x^3 + 2.0x^2 - 29.0x + 42.0}{x^3 + 10.0x^2 + 19.0x - 30.0}$
- C.  $f(x) = \frac{x^3 + 3.0x^2 - 25.0x + 21.0}{x^3 + 10.0x^2 + 19.0x - 30.0}$
- D.  $f(x) = \frac{x^3 - 7.0x^2 - 9.0x + 63.0}{x^3 - 10.0x^2 + 19.0x + 30.0}$
- E. None of the above are possible equations for the graph.

21. Determine the vertical asymptotes and holes in the rational function below.

$$f(x) = \frac{12x^3 + 25x^2 - 48x - 45}{12x^2 + 17x + 6}$$

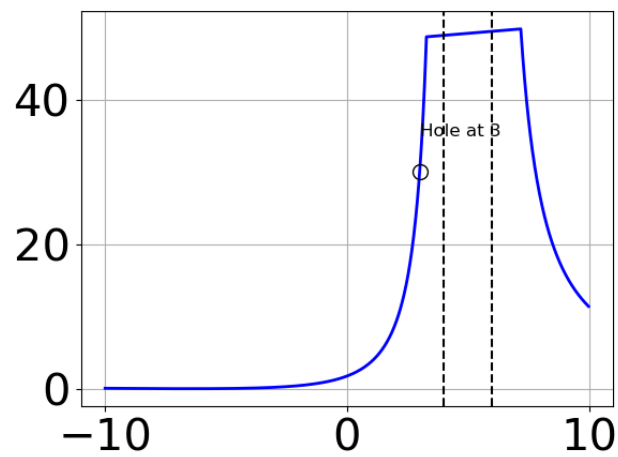
- A. Vertical Asymptote of  $x = -0.667$  and hole at  $x = -0.75$
  - B. Vertical Asymptotes of  $x = -0.667$  and  $x = 1.667$  with a hole at  $x = -0.75$
  - C. Vertical Asymptotes of  $x = -0.667$  and  $x = -0.75$  with no holes.
  - D. Vertical Asymptote of  $x = 1.0$  and hole at  $x = -0.75$
  - E. Holes at  $x = -0.667$  and  $x = -0.75$  with no vertical asymptotes.
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22. Determine the vertical asymptotes and holes in the rational function below.

$$f(x) = \frac{4x^3 - 16x^2 - 25x + 100}{6x^2 + 11x - 10}$$

- A. Holes at  $x = 0.667$  and  $x = -2.5$  with no vertical asymptotes.
  - B. Vertical Asymptote of  $x = 0.667$  and hole at  $x = -2.5$
  - C. Vertical Asymptotes of  $x = 0.667$  and  $x = -2.5$  with no holes.
  - D. Vertical Asymptote of  $x = 0.667$  and hole at  $x = -2.5$
  - E. Vertical Asymptotes of  $x = 0.667$  and  $x = 2.5$  with a hole at  $x = -2.5$
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23. Which of the following functions *could* be the graph below?

$x=6$ 

- A.  $f(x) = \frac{x^3 - 10.0x^2 + 3.0x + 126.0}{x^3 + 13.0x^2 + 54.0x + 72.0}$
- B.  $f(x) = \frac{x^3 + 10.0x^2 + 3.0x - 126.0}{x^3 - 13.0x^2 + 54.0x - 72.0}$
- C.  $f(x) = \frac{x^3 + 12.0x^2 + 29.0x - 42.0}{x^3 - 13.0x^2 + 54.0x - 72.0}$
- D.  $f(x) = \frac{x^3 - 11.0x^2 + 16.0x + 84.0}{x^3 + 13.0x^2 + 54.0x + 72.0}$
- E. None of the above are possible equations for the graph.
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24. Determine the vertical asymptotes and holes in the rational function below.

$$f(x) = \frac{12x^3 + 41x^2 + 40x + 12}{16x^2 - 9}$$

- A. Vertical Asymptote of  $x = 0.75$  and hole at  $x = -0.75$
- B. Vertical Asymptote of  $x = 0.75$  and hole at  $x = -0.75$
- C. Vertical Asymptotes of  $x = 0.75$  and  $x = -0.75$  with no holes.
- D. Vertical Asymptotes of  $x = 0.75$  and  $x = -0.667$  with a hole at  $x = -0.75$
- E. Holes at  $x = 0.75$  and  $x = -0.75$  with no vertical asymptotes.
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25. Determine the horizontal and/or oblique asymptotes in the rational function below.

$$f(x) = \frac{12x^3 - 37x^2 - 3x + 18}{4x^2 + 5x - 6}$$

- A. Horizontal Asymptote of  $y = -2.0$  and Oblique Asymptote of  $y = 3x - 13$
- B. Horizontal Asymptote of  $y = 3.0$  and Oblique Asymptote of  $y = 3x - 13$
- C. Horizontal Asymptote at  $y = -2.0$
- D. Oblique Asymptote of  $y = 3x - 13$ .

E. Horizontal Asymptote of  $y = 3.0$

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26. Determine the horizontal and/or oblique asymptotes in the rational function below.

$$f(x) = \frac{4x^3 - 4x^2 - 23x + 30}{-6x^3 + 8x^2 + 17x - 30}$$

- A. Horizontal Asymptote of  $y = -0.667$
  - B. Vertical Asymptote of  $y = 2$
  - C. Vertical Asymptote of  $y = -1.667$
  - D. Horizontal Asymptote of  $y = 0$
  - E. None of the above
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27. Determine the vertical asymptotes and holes in the rational function below.

$$f(x) = \frac{6x^3 - 37x^2 + 75x - 50}{12x^2 - 35x + 25}$$

- A. Vertical Asymptotes of  $x = 1.25$  and  $x = 1.667$  with no holes.
  - B. Vertical Asymptote of  $x = 0.5$  and hole at  $x = 1.667$
  - C. Vertical Asymptotes of  $x = 1.25$  and  $x = 2.5$  with a hole at  $x = 1.667$
  - D. Holes at  $x = 1.25$  and  $x = 1.667$  with no vertical asymptotes.
  - E. Vertical Asymptote of  $x = 1.25$  and hole at  $x = 1.667$
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28. Determine the horizontal and/or oblique asymptotes in the rational function below.

$$f(x) = \frac{12x^3 + 59x^2 + 79x + 30}{4x^2 - 7x - 15}$$

- A. Horizontal Asymptote at  $y = 3.0$

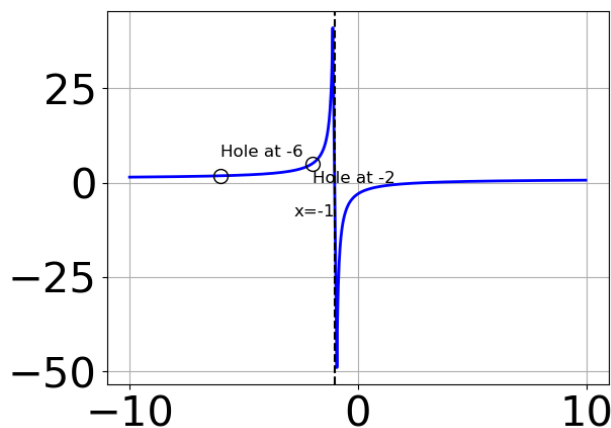
- B. Oblique Asymptote of  $y = 3x + 20$ .
- C. Horizontal Asymptote of  $y = 3.0$
- D. Horizontal Asymptote of  $y = 3.0$  and Oblique Asymptote of  $y = 3x + 20$
- E. Horizontal Asymptote of  $y = 3.0$  and Oblique Asymptote of  $y = 3x + 20$

29. Determine the horizontal and/or oblique asymptotes in the rational function below.

$$f(x) = \frac{30x^3 - 163x^2 + 187x - 60}{-20x^3 + 34x^2 - 94x + 24}$$

- A. Horizontal Asymptote of  $y = 0$
- B. Horizontal Asymptote of  $y = -1.500$
- C. Vertical Asymptote of  $y = 4$
- D. None of the above
- E. Vertical Asymptote of  $y = 0.500$

30. Which of the following functions *could* be the graph below?



A.  $f(x) = \frac{x^3 + 5.0x^2 - 12.0x - 36.0}{x^3 + 9.0x^2 + 20.0x + 12.0}$

B.  $f(x) = \frac{x^3 - 5.0x^2 - 12.0x + 36.0}{x^3 - 9.0x^2 + 20.0x - 12.0}$

C.  $f(x) = \frac{x^3 + 6.0x^2 + 11.0x + 6.0}{x^3 - 9.0x^2 + 20.0x - 12.0}$

D.  $f(x) = \frac{x^3 + 6.0x^2 - 7.0x - 60.0}{x^3 + 9.0x^2 + 20.0x + 12.0}$

E. None of the above are possible equations for the graph.

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